The NITON 800 Series Multi-Element Spectrum Analyzer with bar code template and shielded belt pouch

Idaho National Engineering and Environmental Laboratory

Technical Deployment Summary Sheet

NITON® 800 SERIES MULTI-ELEMENT SPECTRUM ANALYZER (ALLOY ANALYZER)

THE NEED

A need existed at the Miamisburg Environmental Management Project (MEMP), commonly known as the Mound Site, for a non-invasive, in-situ, real-time analysis tool to identify the alloy and chemical composition of a metallic tank. This non-invasive, real-time analysis tool provided the information needed to segregate this tank for either reuse or dismantlement. The current method involves collecting samples and shipping them to a laboratory for analysis. This costs over $4,500 per sample and takes up to 3 months to receive the laboratory results.

THE TECHNOLOGY

The NITON 800 series analyzer uses X-ray fluorescence (XRF) spectrum analysis to identify and quantify elements in metal and then compares the readings to a built-in library to determine the alloy. The library contains 300 elements and alloys and can be customized. The basic unit uses a Cadmium-109 source, but each analyzer unit can hold up to two sources. In the future, Iron-55 and Americium-241 will be available as second sources. Iron-55 will provide greater sensitivity in the range between Silicon-16 to Chromium-24, and Americium-241 will provide greater sensitivity in the range between Rhodium-45 to Terbium-66. Pushing a safety button on the side of the unit and placing it against a surface opens the shutter window. The unit beeps at 5, 20, and 60-second intervals, and the results are displayed when the unit is removed from the surface. The longer the instrument analyzes a surface, the more accurate the analysis. The analyzer can store up to 1,000 data sets, including sample identification codes using a barcode reader. The data is easily downloaded to a conventional personal computer when sampling has been completed. The NITON 800 series analyzer is a surface scanner only, so contaminants of an alloy nature and coatings can effect the readings. Surface preparation from wiping the surface clean to scraping paint or grinding off a coating may be necessary to obtain an accurate reading. The NITON 800 series analyzer is an 8 x 3 x 2-in. hand-held, battery-operated unit. It weighs 2.5 pounds with a price starting at approximately $28,000. Batteries are usable for 8 hours and can be charged in less than 2 hours. Conforming to 49 CFR 173.421, the NITON 800 series analyzer can be carried, shipped, or transported without exterior labeling.

THE DEMONSTRATION

The INEEL possesses an alloy analyzer, procured and demonstrated under a previous Large Scale Demonstration and Deployment Project. This unit was available and was shipped overnight to Mound for this application. The NITON 800 series analyzer was deployed in January 2002 at the Mound site in order to determine the alloy makeup and hence, the disposition path, of a stainless steel tank which had been removed from a Tritium system. It was used to characterize the tank metal on the various surfaces of the tank and support legs. No special requirements were placed on the use of the instrument because of the low activity and self-contained nature of the NITON radiation sources. The instrument self-calibrates on startup, but a Quality Assurance (QA) certified sample can be used to ensure instrument accuracy. The instrument also uses a three-step process for opening the shutter for each measurement. For this use, the 20-second data collection interval was used for each of the seven measurements taken. In all it took about 30 minutes of field time. These readings were recorded in the

The NITON Analyzer takes a reading on a tank awaiting dispositioning on the SM/PP Hill lay-down pad at Mound.

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field and are shown in the results commentary. After the deployment, the instrument was returned to INEEL where the data was downloaded to a personal computer and sent back to Mound.

THE RESULTS

Using the NITON 800 Alloy Analyzer, Mound was able to confirm the expected alloy using the element concentrations listed within the NITON 800 installed library. The Data from the NITON 800 series analyzer is in % by weight concentration, which is the standard measurement for metal alloy composition. The laboratory analysis process would quantify all of the elements of the periodic table, providing a more complete chemical analysis but this was not necessary for the dispositioning of the tank. The analyzer was user friendly, simple to operate, and easy to understand. Mound uses a NITON Pb paint analyzer and the alloy analyzer operates similarly so no additional training was required.

No.	Location	Cr %	Fe %	Ni %	Other %	Alpha counts	Beta counts
1	Bottom of tank wall	17.3	71.6	9.4	0	770	64
2	Bottom surface of tank	18.4	72.0	9.1	0	1322	150
3	Upper surface of tank	17.4	71.6	9.1	0	215	69
4	Leg		55.9		Ti 39.2 Co 2.3 Zn 1.4		
5	Bottom circumference ring	17.4	70.4	11.2	0	69	BKG
6	Bottom small outlet flange		1.4		Zn 2 (Al, Si) 94.9	57	BKG
7	Upper flange	17.6	70.5	10.2	0	19	BKG
	NITON 304 SS Library %	18 - 20	Balance	8 - 10.5	Mn 0 - 2.0 Mo 0 - 0.3		

BENEFITS

- Shipping costs for the analyzer compared to sample collection and laboratory analysis cost (over $ 4,500 per metal sample).
- 20 seconds to get a reading compared to 2 hours to take a metal sample.
- 30 minutes compared to 90 days to obtain the analysis results.
- Ability to make immediate decisions on material type or alloy.
- Ability to identify metal with high salvage value for segregation during dismantlement.
- Ability to immediately identify suspect material for salvage rather than disposed of as waste.

SUMMARY

The analyzer is a hand-held, battery operated unit, which uses x-ray fluorescence spectroscopy to quantify elements in metal and determine the specific alloy of metallic materials. The baseline approach is to collect field samples and send the samples to a laboratory for analysis. Sample collection can take hours and analytical results from the laboratory may not be available for months. The analyzer provides results in about 20 seconds, and the data indicated that a tank targeted for waste disposal had a potential reuse value. With an average laboratory analysis cost per sample of about $4,500, this NITON 800 series analyzer will have paid for itself after measuring just 1 sample if the tank is accepted for reuse.